Space Weather Technical Forecast

Issued on Wednesday, 25 October 2023 at 12:52 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with four C-class flares, the largest peaking at C4 at 24/0001 UTC from a region of plage rotating over the northeast limb. Of the two small and simple sunspots on the disc, AR3471 just west of the south centre disc is the most developmental, with the emergence of small intermediate spots and a clear penumbra forming on the main trailer. AR3468, closer to the southwest limb, persists as a small mature unipolar spot.

No Earth-directed CMEs have been observed. However a filament eruption, with an associated weak coronal dimming was observed just northeast of the centre disc around 25/0750 UTC. It is currently too early to assess the likelihood that a CME was produced, with further imagery required. There are a number of other filaments on the disc that require monitoring.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, remained indicative of a slow wind environment with background speeds, declining from near 400 km/s to around 320km/s. Density was average to below average. Interplanetary Magnetic Field (IMF), Bt, was weak, below 7nT, with its north-south component, Bz, predominately positive (northward) ranging between +5 and -2nT. Phi angle was negative (towards the Sun) until 25/1030 UTC then became positive (away from the Sun). Geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux was mainly background, briefly reaching Moderate with peak 267 pfu at 24/1700 UTC. Associated 24-hour fluence was well below the Active (1e8 integrated pfu) threshold. The observation at 25/0000UTC was 5.32e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity forecast with occasional C-Class flares. There is a slight chance of M-flares, with the main risk currently from AR3471 just west of the southern centre disc.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Background winds are expected to become briefly enhanced by the arrival of the fast winds of CH64/+, most likely on day 3 (27 Oct). Any enhancement is expected to be minimal with winds likely peaking around 450 km/s, before easing day 4 (28 Oct). Geomagnetic activity is forecast to be mainly Quiet, rising to Unsettled with Active spells likely with any fast wind onset day 3 (27 Oct).

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at Background. High energy electron flux (greater than 2MeV) is expected to persist at Background with brief diurnal rises to Moderate possible. The associated 24 hour fluence is forecast to remain below the Active threshold (1e8 integrated pfu).

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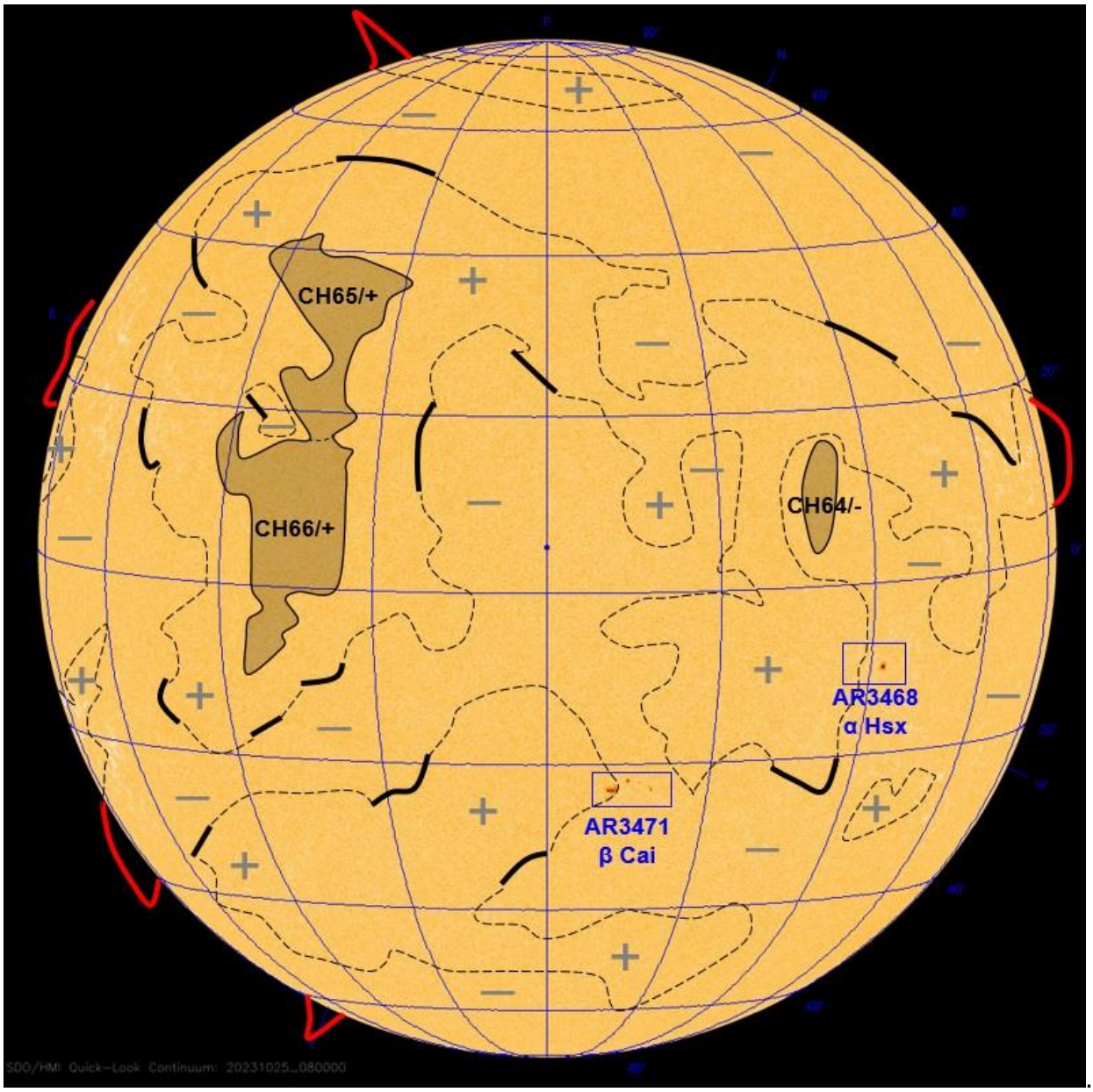
Figure 1. Solar Analysis Valid 25/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

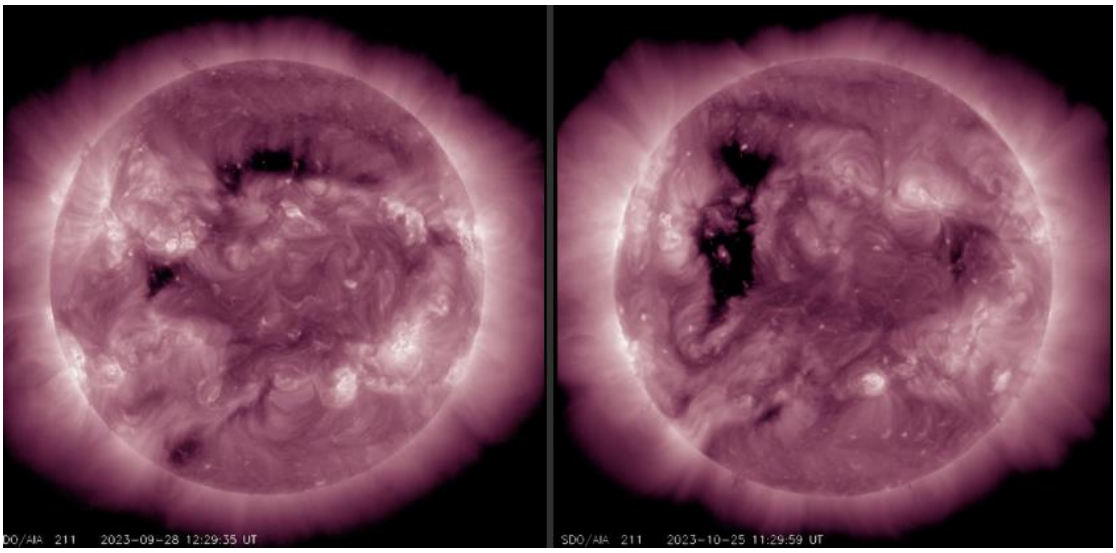
There are no Earth-directed CMEs. There are a number of long filaments visible on the Earth-facing side of the Sun which will need to be watched, as any eruptions have the potential for Earth-directed components.

Background solar winds are expected day 1 and 2 (25-26 Oct). A transition into a weak fast wind is then likely day 3 (27 Oct), from CH64/-, currently situated in the northwest, just north of the Suns equator however, only a limited enhancement is expected, to around 450 km/s. Conversely MOSWOC Enlil suggests a strong fast wind onset albeit with a slightly later arrival time. This appears to either be an overestimation of the fast winds of CH65/+ and CH66/+, which are not expected until after this forecast period, or potentially due to a non-existent central disc coronal hole that is currently within the initial conditions of the model (the PFSS) due to differences with the solar disc between the current and previous Carrington rotation. Any fast wind onset is likely to ease day 4 (28 Oct).

Mainly Quiet geomagnetic activity at first, rising to Unsettled, with isolated Active intervals likely day 3 (27 Oct) from any enhancement from CH64/- fast winds. Activity easing day 4 (28 Oct) to mainly Quiet, with isolated Unsettled spells.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2a: SDO aia 211 of current and previous rotation Clear differences in CH structure.



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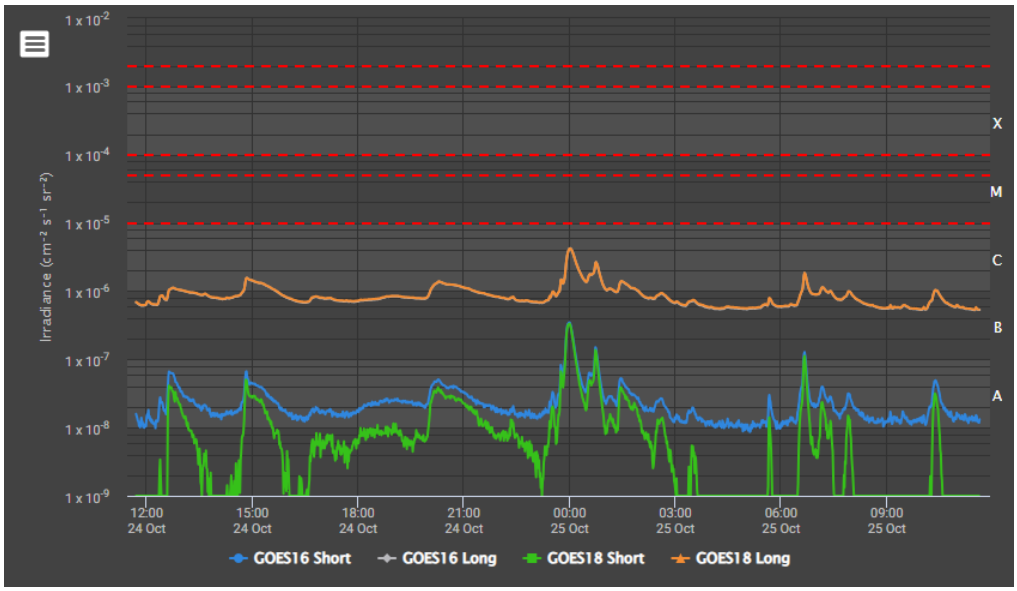
Radio Blackouts - X-Ray Flares:

Low activity is expected with only a slight chance of M-flares, mainly from AR3471.

The recent lull in solar activity continues, with only two small and relatively simple sunspots on the disc. AR3471 is the most developmental, with the emergence of small intermediate spots and a clear penumbra forming on the main trailer. The region remains small and simple however. AR3468 persists as a small and mature unipolar spot. Further small 'pore' like proto-spots are identifiable amidst the plage on the northeast disc, suggests a potential for further spot development through the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	15	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16/18 X-ray Flux



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Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels in the absence of significant sunspot regions on the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

Electron flux observed by GOES16 at GEO is currently at Background levels with only slight diurnal rises to Moderate expected. No significant increase to electron populations through the Van Allen Belt is expected during this period with only a weak coronal hole enhancement forecast on day 3 (27 Oct) due to CH64/-.

The associated 24hr electron fluence is forecast to remain below the Active level. This is supported by REFM, while persistence provides a poor guide due to the arrival of CMEs on the previous rotation.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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